enhanced lines. Little is said about this chemical classification by Miss Clerke, and nothing in its favour, yet it represents the conclusions of a lifetime devoted to the study of spectra in the laboratory and observatory, and abundant material relating to it appears in the Proceedings of the Royal Society. Anyone unfamiliar with this material who reads what Miss Clerke has to say upon the temperatures of the stars and the interpretation of stellar spectra would have an inadequate idea of the results of systematic studies of these subjects, or of the existence of substantial ground of appeal against her verdict.

An instance of an incomplete statement that tends to mislead the reader is afforded by the note on Sir William and Lady Huggins's experiments on the behaviour of the H and K lines of the spectrum of calcium (Roy. Soc., June 17, 1897). By reducing the density of calcium vapour the lines H and K were obtained alone, and it was concluded that the various appearances of calcium lines in celestial bodies were due to the different states of density of the gases from which the lines were emitted or absorbed, and not to degrees of dissociation. The H and K lines in the solar spectrum are considered to prove the existence of "the metal calcium in a highly rarefied state"; and upon this evidence, referring to the condition of this element, Miss Clerke remarks:—"The hypothesis of its dissociation in the sun thus remains unverified." As a matter of logic, the experiments only prove that the H and K lines of calcium are spectroscopically persistent, and were able to survive (as might have been expected) conditions which effaced weaker lines in the spectrum of the element. Because brachiopods belonging to the genus Lingula are found in the sea at the present day as they were in Palæozoic ages, while many other forms that were contemporary have disappeared, we do not conclude that organic evolution is impossible, but only that the organism represents a type which persists in spite of changes of conditions. In the same way the continued existence of the H and K lines affords no evidence whatever against the view that there are different molecular groupings of calcium at different temperatures. By reducing the density of the calcium vapour, Sir William and Lady Huggins reduced the quantity acted upon; so the dissociated condition represented by the appearance of H and K alone was reached sooner. Similar experiments were made by Sir Norman Lockyer in 1879, and the conclusion arrived at was that a reduction in the quantity of a substance generally simplifies the spectrum. "In all probability the effects hitherto ascribed to quantity have been due to the presence of the molecular groupings of greater complexity. The more there is to dissociate, the more time is required to run through the series, and the better the first stages are seen" (Roy. Soc. Proc., vol. xxx., p. 26).

It will be seen, therefore, that the principal point of Sir William and Lady Huggins' experiment on calcium vapour at different densities was the subject of laboratory experiments more than twenty years earlier, and that their conclusion, though it is mentioned by Miss Clerke without reservation or reference to previous investigations, is not a safe one to apply to the consideration of the condition of calcium in the sun or stars as indicated by spectroscopic appearance. Moreover, if the changes of the calcium spectrum are interpreted as effects of tenuity, the similar spectral variations of magnesium and iron ought to admit of a like explanation, whereas there is good evidence that they are due to constitutional changes brought about by thermal or electric action.

Many other debatable matters are dealt with by Miss Clerke in a manner which suggests that the last word has been said upon them when she is really only presenting one side of a case. It may be assumed that, like a good advocate, she is as familiar with the defendant's case as she is with the plaintiff's, but the real strength of the evidence opposed to the views she adopts could only be shown by the disciple of another school of spectroscopy; and a small volume would be required to plead this cause. No writer on astronomy has a more facile pen than has Miss Clerke, and we can forgive the occasional florid style when we remember the vast amount of reading and careful analysis involved in the preparation of a volume of this kind. The work is so good that every student of astronomical physics must be familiar with it, and every astronomical library must include it. Because of its essential qualities it is to be regretted that a broad view has not been taken of all contributions to the subject made by competent investigators; for by neglecting such aspects as have been referred to in the foregoing paragraphs an incomplete story is presented of the meaning and mysteries of sidereal development revealed by spectroscopic research.

R. A. GREGORY.

BRITISH ASCIDIANS.

The British Tunicata: an Unfinished Monograph. By the late Joshua Alder and the late Albany Hancock. Edited by John Hopkinson, with a History of the Work by the Rev. A. M. Norman, F.R.S., &c. Vol. i. Pp. xvi+146+xx plates. (London: Printed for the Ray Society, 1905.) Price 12*s.* 6*d.* net.

THERE are probably few precedents for the publication of an unfinished biological monograph thirty years after the authors penned their last remarks, especially of a monograph dealing with a group which has been the object of much detailed investigation by other hands in the interval. The chequered history of the present work is briefly, but sympathetically, told by Canon Norman, from whose preface the following paragraph may be extracted:—

> "Though so many years have elapsed, the value of this Monograph is great, since (1st) it contains full descriptions with illustrations of the Tunicata of our fauna as known up to the time of the death of the authors; (2nd) because many of the new species had been only briefly diagnosed, and the fuller descriptions and figures of these which are now given will enable them to be better known and understood; and (3rd) it is especially desirable that the full account of Hancock's investigations should be published together with a portion of his beautiful drawings."

© 1906 Nature Publishing Group

For these reasons the student of the Tunicata cannot be otherwise than grateful to the Ray Society for the publication of this work, and especially for the liberality with which it has been illustrated. The coloured figures representing many of the authors' species must rank among the best figures of ascidians extant, and the numerous collotype reproductions of Hancock's drawings of the branchial sac, &c., will greatly facilitate the task of identification.

The first volume, which we hope may soon be followed by the remainder of the work, contains (1) the authors' introduction (a historical summary of British records of Tunicata up to the year 1870), (2) a reprint of Hancock's paper "On the Anatomy and Physiology of the Tunicata" (published by the Linnean Society in 1867), and (3) an account of thirty British species referred by the authors to the genus Ascidia. Two of these so-called species are now described for the first time, viz. *Ascidia amoena* and *Ascidia Morei.*

It is no discredit to the memory of the distinguished authors of this monograph, whose general accuracy of observation has long been established, if we express a conviction that no modern expert in this group of marine animals will be prepared to recognise the claims of half Alder and Hancock's "species" to specific rank. It is not improbable that the thirty forms described in the monograph will be ultimately referred to some ten or twelve "good species" at most.

Excluding *Ascidia canina,* the relations of which to *Ciona intestinalis,* L., appear, strangely enough, to have been overlooked by Hancock, the remaining twenty-nine species of Ascidia, as described by the authors, would in these days be referred to the three genera Phallusia (with the single species *mamillata*), Ascidia and Ascidiella of Roule. Adopting for the moment Alder and Hancock's specific names, and confining our attention to the forms dealt with in their monograph, we may say that each of the genera Ascidia and Ascidiella includes three main types. To Ascidia (*s. str.*) belong (1) *mentula,* with which *robusta, rubicunda,* and *rubrotincta* are probably synonymous; (2) *mollis,* with *crassa, plana, Alderi,* and possibly *rudis,* as allies; and (3) *plebeia* (= *conchilega* of Müller), with which *producta, inornata,* and *depressa* are closely related or synonymous. To Ascidiella belong (1) *obliqua* (=*prunum* of Müller), to which the new species *amoena* appears to be related; (2) *venosa,* and (3) a large series of very variable forms referable in the main to the types *sordida* (=*virginea* of Müller), *scabra,* and *pustulosa* (=*aspersa* of Müller), of one or other of which the authors' "species" *elongata, aculeata, Morei, Normani, affinis, elliptica, pellucida, orbicularis,* and *vitrea* appear to be merely varieties or local forms.[1]

There is probably no group of animals in which external conditions exert a greater influence upon the size, shape, and structure of the body than in the case of the ascidians, owing to their permanent fixation under the most diverse natural conditions, their mode of feeding, and the plastic character of the test which serves them for a skeleton. Differences in the supply of food alone—and no factor is liable to greater extremes than the amount of phytoplankton in littoral waters—must influence the development of an ascidian's body in so many different ways that great variability must be the rule rather than the exception. In these circumstances it is doubtful if the natural history of this group can be adequately treated in any monograph until much additional work has been done, not only in the systematic observation of the nature and extent of local variations, but also in direct experiments concerning the effect of different conditions upon the growth of the progeny of selected parents. Until such work has been done, any attempt to define specific limits within (*e.g.*) the *virginea-scabra-aspersa* group must remain a mere expression of personal opinion.

In the meantime the publication of the present work is likely to lead to the clearing up of many uncertainties, provided it is regarded mainly as a repository of facts, and not as an authoritative guide to the classification or nomenclature of the group.

This aspect of the work has been fortunately retained under the editorship of Mr. Hopkinson, who has restricted his notes to the addition of such bibliographic and distributional records, published prior to 1871, as were necessary for the completion of the authors' MSS. up to the date of Hancock's latest work. The editorial footnote "on the intimate relationship existing between the Tunicata and the Polyzoa," on the first page of the authors' introduction, conveys just the right touch of archaic suggestiveness.

We notice a couple of misprints: Weigmann for Wiegmann (pp. 7 and 12), and Mongula for Molgula (p. 46); and may point out that Figs. 8 and 9 on plate xi. represent not "probably a variety of *Corella parallelogramma,*" but Hancock's own species, *Corella larvaeformis,* which we presume will be described in the second volume of the monograph.

W. GARSTANG.

THE METALLURGY OF IRON AND STEEL.

Elementary Practical Metallurgy, Iron and Steel. By Percy Longmuir. Pp. xiii+270+13 plates. (London: Longmans, Green and Co.) Price 5*s.* net.

WORKS on practical metallurgy have generally consisted of descriptions of series of experiments suitable for performance in an ordinary laboratory possessing the usual equipment with small assay furnaces; but this book is an elementary work on the metallurgy of iron and steel, written with the view not only of serving the needs of the ordinary beginner among students, but of attracting the severely practical man to the study of metallurgical literature, and thus helping him ultimately to the position of being able to throw the light of new discoveries on his daily work, and to make application of suitable results—evidently a practical apostle of the methods of the British Science Guild. The writer thoroughly agrees

---

[1] For a fuller discussion of the relations of particular species special reference should be made to Prof. Herdman's paper in *Jour. Linn. Soc.*, xxiv., 1893, and Hartmeyer's "Holosome Ascidien" in "Meeresfauna von Bergen," 1901.

© 1906 Nature Publishing Group